

CLAIMS:

1           1.     A system for dynamically allocating bandwidth between one or more customer  
2     services to provide a switched data network for broadcast data, comprising:

3                 one or more different customer service providers that each provide different data to one  
4     or more customers;

5                 one or more service nodes wherein each service nodes provides data to one or more  
6     customers and each service node receives a unique multiplex of digital data for its customers;  
7     and

8                 a dynamic bandwidth allocation module for allocating the bandwidth of the system  
9     between the one or more different customer service providers to the one or more service nodes  
10    wherein the bandwidth assigned to each customer service provider for each service node is  
11    dynamically adjustable based on the usage of the services by the customers and the bandwidth  
12    requests of each service providers.

1           2.     The system of Claim 1, wherein the dynamic bandwidth allocation module further  
2     comprises a bandwidth manager that receives bandwidth requests from the one or more customer  
3     service providers and assigns bandwidth to each of the customer service providers for each  
4     service node and a remultiplexer module, based on the bandwidth allocation decisions of the  
5     bandwidth manager, that generates the digital data multiplex for each service node based on the  
6     bandwidth allocations.

1           3.     The system of Claim 2, wherein the customer services comprise one or more of  
2 video on demand, IP data and broadcast data.

1           4.     The system of Claim 3, wherein each service node further comprises a cable  
2 modem termination so that cable modem IP data is included in a multiplex to a service node.

1           5.     The system of Claim 2, wherein the bandwidth manager further comprises a  
2 decision tree having one or more rules for determining the allocation of the bandwidth for each  
3 service node.

1           6.     The system of Claim 5, wherein the bandwidth allocation rules further comprise,  
2 for each service node, if no customer is using a particular customer service, then degrading the  
3 bandwidth allocated to that customer service,

1           7.     The system of Claim 1, wherein the bandwidth allocation comprises one or more  
2 of permanent bandwidth allocation, period of time bandwidth allocation and as available  
3 bandwidth allocation.

1           8.     The system of Claim 7, wherein the bandwidth allocation to each customer  
2 service further comprises a maximum bitrate and an average bitrate.

1           9.     The system of Claim 1, wherein the remultiplexer further comprises means for  
2 dropping a customer service provider from the multiplex for a particular service node.

1           10.     The system of Claim 9, wherein the dropping means further comprises a ring  
2     buffer for adding the dropped customer service back into the multiplex with minimum latency.

1           11.     The system of Claim 10, wherein the ring buffer further comprises an MPEG  
2     group of pictures containing at least one I-frame so that the customer service is reintroduced into  
3     the multiplex with minimal latency.

1           12.     The system of Claim 2, wherein the bandwidth manager further comprises means  
2     for assigning a quality of service to one or more of the customer services based on the bandwidth  
3     requests from the customer service providers.

1           13.     The system of Claim 12, wherein the quality of service assigner further comprises  
2     means for allocating a minimum guaranteed bandwidth for a particular customer service.

1           14.     The system of Claim 12, wherein the quality of service assigner further comprises  
2     means for allocating minimum bandwidths simultaneously to multiple customer services.

1           15.     The system of Claim 12, wherein the quality of service assigner further comprises  
2     means for assigning a variable minimum bandwidth to one or more customer services.

1           16.     The system of Claim 15, wherein the variable minimum bandwidth comprises one  
2     or more of a time of day adjustable bandwidth allocation and a usage level adjustable bandwidth  
3     allocation.

1           17.    The system of Claim 12, wherein the quality of service assigner further comprises  
2 means for assigning a quality of service to customer services that have been degraded or  
3 eliminated from a multiplex.

1           18.    The system of Claim 17, wherein the quality of service assigner further comprises  
2 a ring buffer for maintaining a continuous loop of data to be able to reinsert the degraded or  
3 eliminated customer service with minimal latency.

1           19.    The system of Claim 17, wherein the quality of service assigner further comprises  
2 a I-frame carousel for maintaining at least an I-frame of the data of the customer service to restart  
3 the customer service with minimal latency.

1           20.    The system of Claim 2, wherein the remultiplexer further comprises means for  
2 assigning a program mapping table to each consumer premises equipment.

1           21.    A method for dynamically allocating bandwidth between one or more customer  
2 services to provide a switched data network for broadcast data, the one or more different  
3 customer service providers each providing different data to one or more service nodes, the one or  
4 more service nodes providing data to one or more customers and each service node receives a  
5 unique multiplex of digital data for its customers, comprising:

6           allocating the bandwidth of the system between the one or more different customer  
7 service providers to the one or more service nodes wherein the bandwidth assigned to each

customer service provider for each service node is dynamically adjustable based on the usage of the services by the customers and the bandwidth requests of each service providers.

22. The method of Claim 21, wherein the dynamic bandwidth allocation further comprises managing the bandwidth to the one or more customer services with a bandwidth manager that receives bandwidth requests from the one or more customer service providers and assigns bandwidth to each of the customer service providers for each service node and generating multiplexes, based on the bandwidth allocation decisions of the bandwidth manager, that generates the digital data multiplex for each service node based on the bandwidth allocations.

23. The method of Claim 22, wherein the bandwidth management further comprises using a decision tree having one or more rules for determining the allocation of the bandwidth for each service node.

24. The method of Claim 23, wherein the bandwidth allocation rules further comprise, for each service node, if no customer is using a particular customer service, then degrading the bandwidth allocated to that customer service,

25. The method of Claim 21, wherein the bandwidth allocation comprises one or more of permanent bandwidth allocation, period of time bandwidth allocation and as available bandwidth allocation.

26. The method of Claim 25, wherein the bandwidth allocation to each customer service further comprises a maximum bitrate and an average bitrate.

1           27.     The method of Claim 21, wherein generating the multiplexes further comprises  
2 dropping a customer service provider from the multiplex for a particular service node.

1           28.     The method of Claim 27, wherein the dropping further comprises using a ring  
2 buffer for adding the dropped customer service back into the multiplex with minimum latency.

1           29.     The method of Claim 28, wherein the ring buffer further comprises generating a  
2 loop of MPEG group of pictures containing at least one I-frame so that the customer service is  
3 reintroduced into the multiplex with minimal latency.

1           30.     The method of Claim 22, wherein the bandwidth management further comprises  
2 assigning a quality of service to one or more of the customer services based on the bandwidth  
3 requests from the customer service providers.

1           31.     The method of Claim 30, wherein the quality of service assignment further  
2 comprises allocating a minimum guaranteed bandwidth for a particular customer service.

1           32.     The method of Claim 30, wherein the quality of service assignment further  
2 comprises allocating minimum bandwidths simultaneously to multiple customer services.

1           33.     The method of Claim 30, wherein the quality of service assignment further  
2 comprises assigning a variable minimum bandwidth to one or more customer services.

1           34.    The method of Claim 33, wherein the variable minimum bandwidth comprises  
2 one or more of a time of day adjustable bandwidth allocation and a usage level adjustable  
3 bandwidth allocation.

1           35.    The method of Claim 30, wherein the quality of service assignment further  
2 comprises assigning a quality of service to customer services that have been degraded or  
3 eliminated from a multiplex.

1           36.    The method of Claim 35, wherein the quality of service assignment further  
2 comprises maintaining a loop of data in a ring buffer to be able to reinsert the degraded or  
3 eliminated customer service with minimal latency.

1           37.    The method of Claim 35, wherein the quality of service assignment further  
2 comprises maintaining at least an I-frame in an I-frame carousel to restart the customer service  
3 with minimal latency.

1           38.    The method of Claim 22, wherein generating the multiplexes further comprises  
2 assigning a program mapping table to each consumer premises equipment.

1           39.    A dynamic bandwidth allocation device, comprising:  
2           a dynamic bandwidth allocator that allocates the bandwidth of a system between one or  
3 more different customer service providers to one or more service nodes wherein the bandwidth  
4 assigned to each customer service provider for each service node is dynamically adjustable based

5 on the usage of the services by the customers and the bandwidth requests of each service  
6 providers;

7 the dynamic bandwidth allocator further comprising a bandwidth manager that receives  
8 bandwidth requests from the one or more customer service providers and assigns bandwidth to  
9 each of the customer service providers for each service node and a remultiplexer module, based  
10 on the bandwidth allocation decisions of the bandwidth manager, that generates the digital data  
11 multiplex for each service node based on the bandwidth allocations.

1 40. The device of Claim 39, wherein the customer services comprise one or more of  
2 video on demand, IP data and broadcast data.

1 41. The device of Claim 39, wherein the bandwidth manager further comprises a  
2 decision tree having one or more rules for determining the allocation of the bandwidth for each  
3 service node.

1 42. The device of Claim 41, wherein the bandwidth allocation rules further comprise,  
2 for each service node, if no customer is using a particular customer service, then degrading the  
3 bandwidth allocated to that customer service.

1 43. The device of Claim 39, wherein the bandwidth allocation comprises one or more  
2 of permanent bandwidth allocation, period of time bandwidth allocation and as available  
3 bandwidth allocation.



44. The device of Claim 43, wherein the bandwidth allocation to each customer service further comprises a maximum bitrate and an average bitrate.

45. The device of Claim 39, wherein the remultiplexer further comprises means for dropping a customer service provider from the multiplex for a particular service node.

46. The device of Claim 45, wherein the dropping means further comprises a ring buffer for adding the dropped customer service back into the multiplex with minimum latency.

47. The device of Claim 46, wherein the ring buffer further comprises an MPEG group of pictures containing at least one I-frame so that the customer service is reintroduced into the multiplex with minimal latency.

48. The device of Claim 39, wherein the bandwidth manager further comprises means for assigning a quality of service to one or more of the customer services based on the bandwidth requests from the customer service providers.

49. The device of Claim 48, wherein the quality of service assigner further comprises means for allocating a minimum guaranteed bandwidth for a particular customer service.

50. The device of Claim 48, wherein the quality of service assigner further comprises means for allocating minimum bandwidths simultaneously to multiple customer services.

51. The device of Claim 48, wherein the quality of service assigner further comprises means for assigning a variable minimum bandwidth to one or more customer services.

1           52.    The device of Claim 51, wherein the variable minimum bandwidth comprises one  
2 or more of a time of day adjustable bandwidth allocation and a usage level adjustable bandwidth  
3 allocation.

1           53.    The device of Claim 48, wherein the quality of service assigner further comprises  
2 means for assigning a quality of service to customer services that have been degraded or  
3 eliminated from a multiplex.

1           54.    The device of Claim 53, wherein the quality of service assigner further comprises  
2 a ring buffer for maintaining a continuous loop of data to be able to reinsert the degraded or  
3 eliminated customer service with minimal latency.

1           55.    The device of Claim 53, wherein the quality of service assigner further comprises  
2 a I-frame carousel for maintaining at least an I-frame of the data of the customer service to restart  
3 the customer service with minimal latency.

1           56.    The device of Claim 39, wherein the remultiplexer further comprises means for  
2 assigning a program mapping table to each consumer premises equipment.